MINISTRY OF TRANSPORTATION

Road Talk

Ontario's Transportation Technology Transfer Digest • Fall 2007 • Vol 13 Issue 3

Roundabouts:

An Innovative Type of Traffic Control

Entrance of a newly constructed roundabout

For the first time in its history, MTO has assembled a Roundabout Implementation Team (RIT) to research and promote the use of roundabouts as an alternative form of traffic control at intersections on provincial highways. The team is comprised of members from Traffic Office, Design & Contract Standards Office, Central, Eastern, Northeastern and Southwestern regions. Its mandate is to look at roundabouts as an opportunity to reduce collisions, delays and fuel usage, while improving air quality through reduced vehicle emissions.

The construction of roundabouts is expanding throughout North America. The ministry's first roundabout at Highway 33 and County Road 1 in Picton, Prince Edward County is scheduled for construction in 2008. The proposal is for a one-lane roundabout with posted speeds of 80 km/h on the north and west approaches, and 60 km/h on the east and south approaches. A number of local road authorities, such as the Region of Waterloo and the City of Hamilton, have constructed roundabouts on municipal roads with a great deal of success.

From a traffic standpoint, improved safety and reduction in delays for drivers are the major benefits of roundabouts. A 2001 study of 23 intersections in the United States reported that converting intersections from traffic signals or stop signs to roundabouts reduced injury-related crashes by 80 percent and all crashes by 40 percent.[1]

Reductions in vehicle emissions resulting from the use of roundabouts are certainly an added bonus in today's environment, where increases in traffic volumes put an added strain on air quality.

Vehicle emissions caused by excessive idling time at signalized intersections can be significant, especially at complex intersections with protected turns and long cycle lengths. In contrast, the yield-at-entry feature of the modern roundabout allows traffic to proceed with minimal delay, stopping at the yield sign only when necessary.

Even in moderate traffic conditions, drivers are able to accept gaps for entry rather than wait through the equivalent of an entire signal cycle. Roundabouts keep traffic moving since fewer vehicles make a complete stop. These savings in time, >

Road Talk is prepared and published quarterly by the Division Services Office, Provincial Highways Management Division, Ontario Ministry of Transportation. Road Talk is distributed electronically in both PDF and HTML forms and is available at:
www.mto.gov.on.ca/english/transtek/roadtalk

This publication reports on innovations and new technology relating to highway management; the design, construction, operation and maintenance of highway infrastructure.

Readers are encouraged to submit articles, news items and comments to

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Technology Transfer is a communication process by which information, regarding an improvement in a product or method, is exchanged and implementation into practice is facilitated.

Ontario

> energy and the environment can be considerable in urban areas.

In one study, replacing a signalized intersection with a roundabout reduced carbon monoxide emissions by 29 percent and nitrous oxide emissions by 21 percent[2]. In an additional study, replacing traffic signals and stop signs with roundabouts reduced carbon monoxide emissions by 32 percent, nitrous oxide emissions by 34 percent, carbon dioxide emissions by 37 percent, and hydrocarbon emissions by 42 percent[3]. Likewise, constructing roundabouts in place of traffic signals can reduce fuel consumption by about 30 percent[2, 4]. At 10 intersections studied in Virginia, this amounted to more than 200,000 gallons of fuel per year[5].

Education will be a key component in helping Ontario drivers feel comfortable when driving a roundabout. Many motorists are not familiar with the rules of the road as they apply to roundabouts, and are therefore opposed to their installation. However, this opposition often turns to support and preference once a roundabout is installed and people become comfortable using it. As part of the education process, MTO has included instructions on how to drive a roundabout in the newly released version of the Official Driver's Handbook.

The use of the modern roundabout with its unique operating characteristics provides an innovative traffic control alternative for the ministry. "Consistent with our goal to improve driver safety and given research has shown the multiple benefits associated with roundabouts, it makes sense that we advance their implementation," states Gerry Chaput, Chief Engineer/Director, Highway Standards Branch. The appropriate use of roundabouts will help improve safety while reducing congestion and vehicle emissions ●

Aerial view of a roundabout with 4 intersections

For more information Contact Barrie Lynn, Senior Project Manager at (416) 235-3959 or Barrie.Lynn@ontario.ca

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Common Questions About Roundabouts

What about snow clearing at roundabouts?
Roundabouts have been installed in a number of areas in North America that regularly experience snow, e.g. Vail, Colorado, and Mont Tremblant, Quebec, both of which are winter ski resort areas. Any concerns regarding snow clearing at roundabouts in Ontario should be surmountable.

What are the differences between roundabouts and traffic circles?
Many people confuse the modern roundabout with traffic circles. At older traffic circles vehicles in the circulatory area had to stop or merge with faster entering traffic and stop signs or signals were sometimes used to help reduce potential collisions. For roundabouts the yield at entry and sharp curve prior to entry make travel speeds in roundabouts much slower than speeds in traffic circles.

Are Roundabouts safe for pedestrians?
Roundabouts are generally safer for pedestrians than traditional intersections. Pedestrians only cross one direction of traffic at a time. Single lane roundabouts; have been reported to involve substantially lower pedestrian collision rates than comparable intersections with traffic signals.

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Commercial Vehicle Inspection Facility Receives An Upgrade

Figure 1: An upgraded primary inspection area at the CVIF in Windsor

Figure 2: Queue management systems such as this one, reduce waiting times for drivers

Figure 3: An upgraded CVIF administration facility in Windsor.

MTO constructed a new style of Commercial Vehicle Inspection Facility (CVIF) in Windsor this past summer. Most truck inspection stations were designed in the past to efficiently weigh trucks. However, changes in enforcement practices required an inspection facility that is flexible and enables efficient mechanical and driver inspections in addition to weight enforcement. The new concept was based on a recent Value Engineering (VE) study examining the site layout and a subsequent study to develop architectural guidelines for building accommodations which were further refined in a recently published CVIF design guidelines. The new CVIF design uses modular components that ensure immediate business needs are addressed with the flexibility to accommodate cost effective expansion in the future as business demands and traffic volumes change.

MTO introduced several technological advances designed to assist inspection processes and enhance employee and industry safety. Enhancements for the CVIF include a queue management system designed to meter trucks into the facility based on capacity, as well as primary and secondary inspection areas. The primary and secondary inspection areas are designed to put the enforcement officer in direct contact with both the truck and driver for the purpose of performing a triage or primary inspection. This approach minimizes delays and provides focus on higher risk carriers who are selected for a more detailed examination in the secondary inspection area. The primary inspection area is also equipped with technology that enables the enforcement officer to access Driver and Vehicle record information, in addition to weigh-in-motion data. The enhancements feature specialized lighting and surface treatments that improve the level of illumination under and around the truck being inspected.

The second CVIF facility is currently being constructed on Highway 402 near the Sarnia/Port Huron International Border Crossing. In addition to the many enhancements introduced at the Windsor facility, the newly constructed Sarnia facility will offer a specialized inspection bay equipped to inspect low profile vehicles. This bay will offer a depression in the paved surface equipped with track lighting for night inspection. The depression will be deep enough for staff to safely manoeuvre under the vehicle to inspect critical components such as brakes and suspension

The collaboration of subject matter experts throughout this Value Engineering exercise has enabled Ontario to design a cost effective facility for the future. The CVIF is now a facility that meets the needs of the industry, and the regulators that oversee their performance ●

For more information, please contact Warren Blackmore, Director, Road User Safety Operations at (416) 235-3526 or Warren.Blackmore@ontario.ca

Upcoming Conference Information

2008 TRB 87th Annual Meeting
January 13-17, 2008
Washington, D.C.

Fourth International Conference on Bridge Maintenance, Safety and Management
July 13-17, 2008
Seoul, Korea

Transportation Association of Canada Annual Conference
September 21-24, 2008
Toronto, Ontario

Prefabricated Bridge Pilot Launched for the Mull Road Underpass

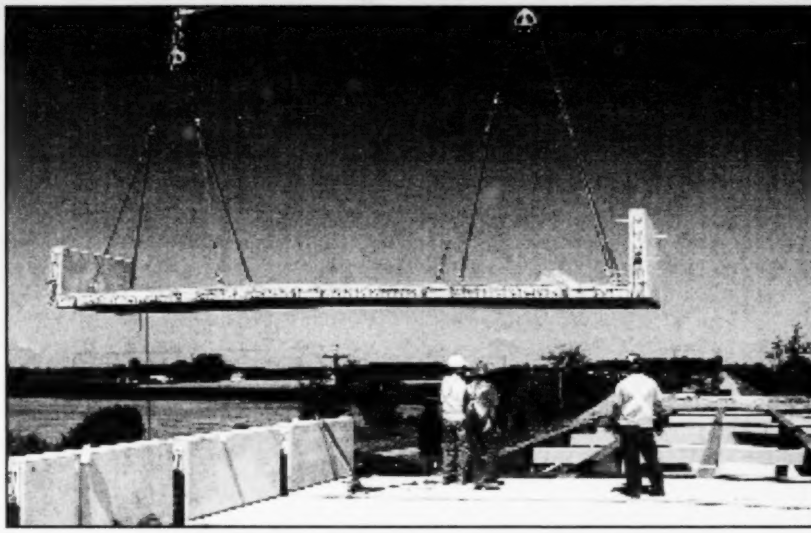


Figure 1: Workers replace the deck of the underpass using prefabricated panels

Ministry of Transportation (MTO) Staff in the Structural Section of Southwestern Region showed their innovative character when they proposed a prefabricated bridge pilot project for the Mull Road Underpass west of London. This bridge is a 4-span slab on steel girder bridge over Highway 401 with an expansion joint at each pier and abutment.

The project was comprised of a complete deck replacement using prefabricated full width and full depth deck panels and refurbishing of the existing steel girders. In addition to casting the parapet walls with the precast slab panels, the design also incorporated a unique "link slab" detail which eliminated the expansion joints at the abutments at a lower cost than all previous designs.

The contract specified that the precast facility be certified by the Canadian Standards Association (CSA) for the production of precast structural elements. The contractor, Facca Incorporated successfully obtained CSA certification for a temporary precasting plant located near the project limits.

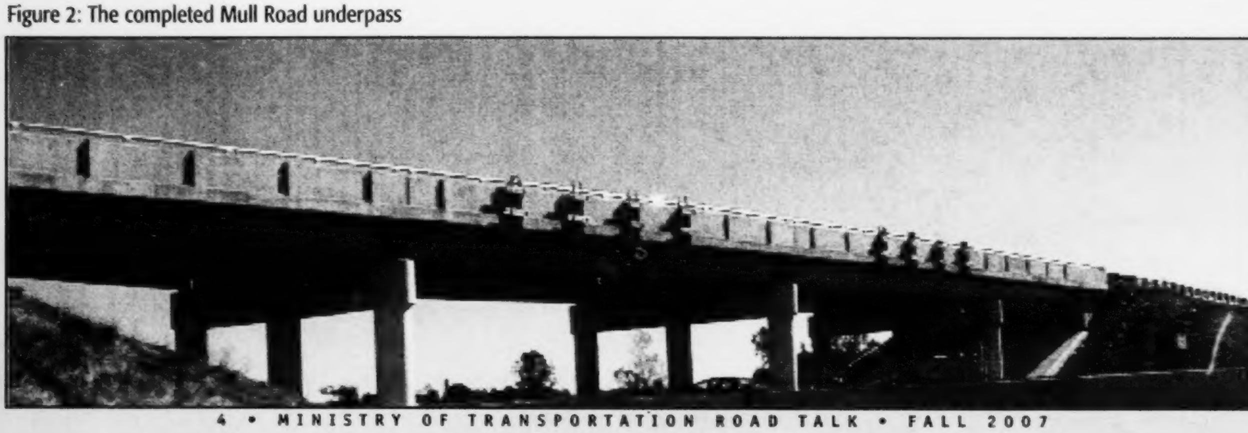
Each panel was precast with exacting precision and then transported to the bridge. Traffic on Highway 401 was reduced to one lane while a 600 ton crane erected the panels with ease at an average production rate of 20 minutes per panel. Levelling devices cast into the slabs, allowed field adjustment of the panels to insure proper positioning. Once in place, shear studs were installed on the steel girders through open pockets cast into the slabs. The panels are connected together via mechanical rebar splices and concrete filled 300mm wide closure strips. Outside ribs or pillars at the exterior face of the parapet were added at closure strips adding a pleasing aesthetic feature to the new structure. Given the right circumstances and more experience, deck panels for a similar bridge could be erected in a single day.

The contributions and support of staff from many areas including Planning & Design, Traffic, Contracts, Bridge Office and McCormick Rankin Corporation were most instrumental to the success of this innovative project.

"Using prefabricated bridge elements and systems means that time-consuming formwork construction, curing, and other tasks associated with field fabrication can be done off-site in a controlled environment without affecting traffic", states Gerry Chaput, Chief Engineer/Director, Highway Standards Branch

For more information, please contact Alain Beaulieu, P.Eng., Co-ordinator, Prefabricated Bridge Systems Implementation Team at (905) 704-2956 or at Alain.Beaulieu@ontario.ca

Figure 2: The completed Mull Road underpass



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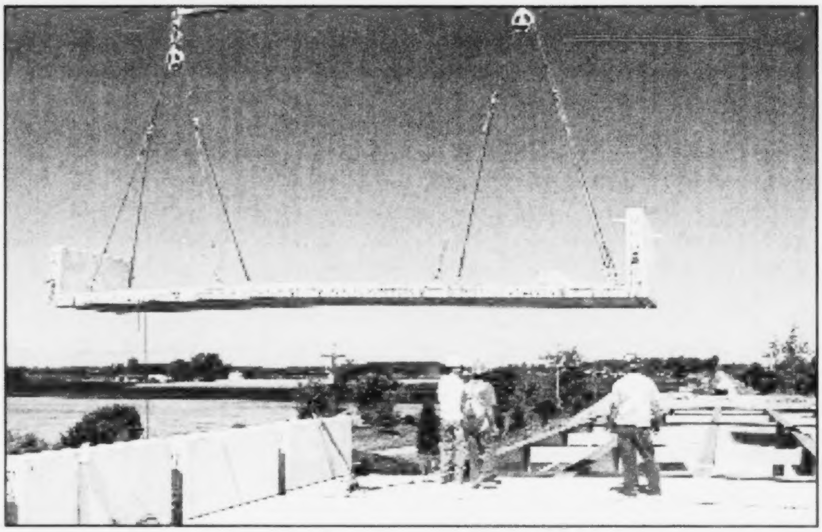

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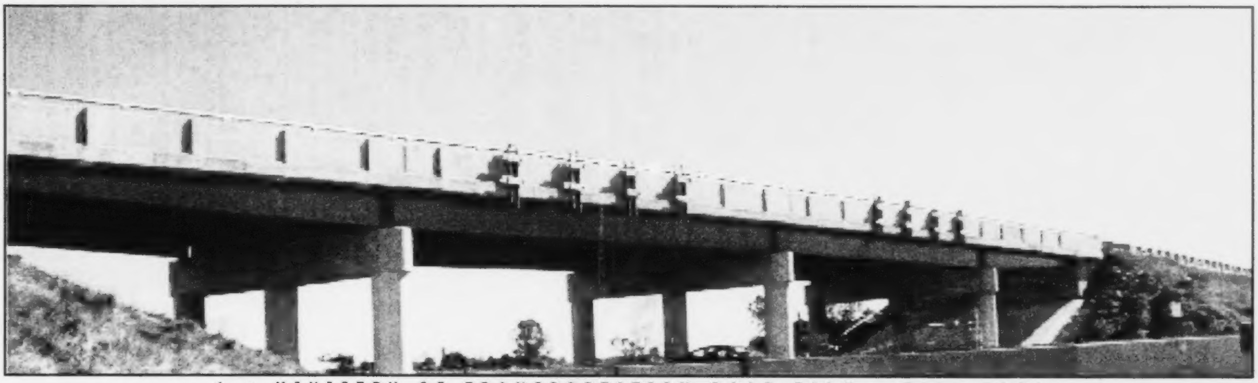

Success!
Island Park Bridges Rapid Replaced Within 17 Hours

On August 11, 2007 Ministry of Transportation (MTO) used rapid replacement technology for the first time to lift, remove and replace 2 existing bridges at Island Park on Highway 417 in Ottawa. The successful operation and took only 17 hours to complete. The Highway was closed at 8:00pm and all lanes were officially open by 1:00pm on August 12th 2007.

Rapid replacement technology is a construction technique whereby a new structure is erected in an enclosed staging area (figure 1), while the existing sub-structure is rehabilitated. Once built, the new structure is then carried over to the site and put in place using Self Propelled Modular Transporters (SPMT) (figure 2), while the old structure is moved to the staging area and dismantled. By replacing the Island Park bridges using rapid replacement technology, impacts on traffic are greatly reduced. A conventional approach would have required extensive lane closures over a period of at least two construction seasons. The savings realized by the rapid replacement approach, in the order of \$2.4 Million, can be attributed mainly to the reduced traffic control requirements.

The design of the Island Park Bridges proved to be a challenging task, as it had to account for the bridges being moved by SPMTs along with the associated stresses and loadings. Other challenges associated with the design and rapid replacement included:

- The elimination of expansion joints through the use of semi-integral abutments.
- Several weekends of preparatory work involving lane closures on the Queensway, due to the excavation of the approach slab in order to cut the ballast wall.
- The top of the ballast wall had to be fastened to the bridge deck so that they could be lifted out and transported together.
- Base plates were installed on the existing bearing seats after the old bridges were moved out. It was a challenge to place the base plates at the correct elevation with shim plates.
- Temperature proved to be a time prolonging factor. Due to the increasing temperature throughout the day, the hot asphalt cooled at a much slower rate then anticipated.

Although the use of rapid replacement technology was very successful, designers learned a number of lessons on how to further improve and facilitate a rapid bridge replacement project. Some key lessons include:

- Allowing the Contractor to use 4 temporary platforms to facilitate removal of existing bridges
- Stressing the importance of the surveying requirements by the Contractor
- The use of adjustable bearing plates cannot be minimized
- Consider specifying temporary lateral restraint plate angles to further facilitate installation of structures
- Replacing longitudinal joint type from "Jeenie" to "Evacon T-300"
- Emphasizing closure times for ramps including limit of closure in modified SP 100F08
- Increased planning and coordination of local road closures by the City in which the construction is taking place
- Increased coordination and communication between MTO, the city, and the C.A

Currently MTO is scheduling more rapid replacement projects. The Clyde Avenue structures are scheduled to be replaced in Summer 2008 using the same rapid lift technology. Starting in 2010 the structures at Carling Avenue Eastbound, Kirkwood Avenue and Carling Avenue Westbound will be replaced using rapid technology ●

For more information, contact
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Frank.Vanderlaan@ontario..ca

Project website:
http://www.417queenswaybridges.ca/

Benefits of Using Prefabrication Technologies:

- Accelerated bridge construction and minimal traffic delays and community disruption
- Reduced site construction time and minimized public exposure to construction hazards
- Need to maintain traffic flow during construction

Figure 1: The new Island Park Bridge under construction in the staging area.

Figure 2: A Self Propelled Modular Transporter (SPMT) carries a bridge deck from the staging area to the final site.

Inertial Profiler Vs. The California Profilograph

Providing motorists in Ontario with smooth driving surfaces and quality roads are among the top priorities for Ministry of Transportation (MTO). New pavements with smooth riding surfaces result in lower vehicle maintenance costs and longer pavement life. Since MTO introduced smoothness requirements on new construction projects in 1997, the riding comfort of Ontario highways has improved by some 25 percent.

Currently, the smoothness of newly constructed roads is being measured using a 7.6 m long wheeled truss called a California Profilograph. California profilographs produce measurements of "Profile Index" or PI (for every 100 m pavement section) and bumps or "scallops" for individual features crossing the pavement surface such as joints.

Although the existing system has worked well, California profilographs can only operate at walking speeds and measure one wheelpath at a time, which exposes the operator to long periods of time in the construction zone. As a result, the construction industry and MTO are working towards replacing California profilographs with more efficient and safer devices for measuring our new construction contracts.

MTO monitors the roughness of our highway network on a yearly basis using a completely different kind of measurement called International Roughness Index (IRI). These measurements are taken using devices such as MTO's Automated Road Analyzer (ARAN). This means that two different kinds of measurements are being taken on the same pavements. If MTO replaces PI with IRI for our new asphalt construction then, from the time a pavement is constructed until it is rehabilitated, it will be measured using the same kind of index.

All of this has lead MTO to investigate state-of-the-art inertial profilers which can be used to accurately measure IRI on our newly constructed pavements. Inertial profilers are generally classified into two different types – i.e. "lightweight profilers" and "high speed profilers". Lightweight profilers consist of golf cart-like vehicles which operate at speeds of 20 to 40 km/hr and high-speed profilers which can travel at regular traffic speed. Although the ARAN and similar devices can be considered high-speed profilers, such devices are also equipped to measure many other kinds of pavement features causing them to be overkill for simply doing contract smoothness acceptance work. In any case, all inertial profilers are equipped with at least one laser to measure the distance from the vehicle to the road surface and one accelerometer to counteract the bouncing effects that the vehicles experience as they move down the road.

The main benefit of inertial profilers is they can measure both wheelpaths, simultaneously (i.e. if two sets of sensors and accelerometers are used) and can report both PI and IRI. Also, since inertial profilers take measurements much faster than the California Prolifographs, they spend less overall time on the road, and are inherently, much safer to operate.

During the fall of 2003, the Bituminous Section at MTO conducted a research project consisting of smoothness measurements on both asphalt and concrete pavements at 8 different locations in eastern Ontario. The project compared measurements taken by lightweight profilers, California profilographs and MTO's ARAN. The main objective was to determine how well a lightweight profiler emulates the current PI-based measurements which are taken by California Profilographs, and to determine new IRI-based acceptance criteria which could be used to replace the existing PI-based ones.

Based on the results of this study and more recent work using high-speed profilers, it appears that many of these devices can be used to replace California Profilographs for the acceptance of new asphalt pavement construction for MTO. In addition, the excellent correlation of IRI between the lightweight profilers and the ARAN suggests that IRI measurements taken by inertial profilers on newly constructed pavements can be used as the benchmark for the long term monitoring of these roads as they become part of MTO's annual network level roughness measurements.

MTO is continues its investigation of state-of-the-art inertial profilers for smoothness acceptance on Ministry contracts. This year, MTO intends to compare side-by-side IRI measurements taken by lightweight and/or high speed profilers with PI measurements taken by California Profilographs on one or more contracts. The results of this work will further validate the IRI-based acceptance limits that were determined in the previous study, but in a more realistic contract environment.

MTO and the Ontario Hot Mix Producers Association continue to work together towards the implementation of inertial profilers for smoothness acceptance on MTO's new asphalt construction contracts ●

For more information contact,
Kai Tam, Manager Bituminous Section,
Highway Standards Branch, at
(416) 235-3725 or Kai.Tam@ontario.ca

Figure 1: A California Profilograph

Figure 2: A Lightweight profiler

Read All About It!

Ontario's First Perpetual Pavement Trial

For the past several years Ministry of Transportation (MTO) engineers have been busy designing, constructing and implementing Ontario's first ever Perpetual Pavement Trial. Perpetual Pavement is a thick asphalt pavement consisting of a flexible, fatigue-resistant, asphalt-rich bottom layer, a strong rut-resistant middle layer, and a smooth, durable renewable surface layer. The bottom layer is comprised of a Superpave25 (SP25) mm Rich Bottom Mix, which is waterproof and more flexible than conventional asphalt mixes.

The objective of using perpetual pavement on highways is to provide a significantly longer road-life than a traditional asphalt pavement. The benefits of using perpetual pavement include ease of maintenance, quick and easy repair, and a smooth and quiet drive for Ontarians.

Highway 406 in the Niagara Region, near Thorold, was selected as the location for the first Perpetual Pavement Trial. The project consisted of twinning an existing 2-lane section of Highway 406 into a 4-lane divided freeway for 5.2 km.

The project was split approximately in half from a pavement design perspective. The north portion has a conventional deep strength asphalt design while the southern half was constructed as the perpetual pavement trial. Grading and earthwork began in late fall 2005. The ministry's first SP25 mm Rich Bottom Mix was laid down in November 2006 and the remainder of the Perpetual Pavement was placed throughout June-July 2007.

The Perpetual Pavement Trial was officially opened to traffic in August 2007. The mix design, placing and compacting was successful, and field reviews have since been carried out. The ministry will be monitoring the performance of this trial section compared to the adjacent conventional flexible pavement design, which acts as a control section. Monitoring will include annual distress surveys to evaluate cracking and use of the ministry's Automated Road Analyser (ARAN) to measure pavement roughness and rutting •

Figure: Perpetual pavement trial on Highway 406, near Thorold.

For more information, please contact Becca Lane, Pavements & Foundations, Highway Standards Branch at (416) 235-3513 or at Becca.Lane@ontario.ca.

New Ontario Traffic Conference Executive Director Appointed

John Crass, President of the Ontario Traffic Conference's Board of Directors, has announced the appointment, effective October 25 2007, of Marco D'Angelo as the Association's new Executive Director.

"I am thrilled to get the opportunity to work with an organization that has a proven track record of working to improve traffic management across Ontario," said D'Angelo.

"I believe that my knowledge of, and experiene within, the Canadian sustainable transportation sector can contribute positively to the priorities of the Ontario Traffic Conference."

D'Angelo was most recently employed as the Director of Public Affairs for the Canadian Urban Transit Association. Prior to his tenure at CUTA, he held senior government relations positions at a number of non-profit organizations as well as working for a Member of Parliament and a municipal Councillor. In addition, Marco D'Angelo holds an MBA from the Ecole des Hautes Etudes Commericales in Montreal as well as undergraduate degrees in Law and Political Science from Carleton University in Ottawa.

The Ontario Traffic Conference was formed in 1950 by a group of municipal officials, who saw the need for a co-ordinated effort to improve traffic management in Ontario, by drawing together the knowledge and expertise of those in the field of Enforcement, Engineering and Education. The OTC draws its members from elected representatives, police services, traffic/transportation engineers, parking, industry and individuals in related fields ●

For more information, please contact Marco D'Angelo, Executive Director at (416) 938-1097

Reader Response

Please help Road Talk become more effective

Send us any ideas, comments, or suggestions concerning local innovations, workshops, or seminars that you would like to see included in future issues.

Road Talk is also available in French.

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Central Tire Inflation Commercial Trial

Low volume roads, which include the 600-Series highways in Northern Ontario, are not designed to the same structural strength as high volume roads. These roads are at their weakest during spring-thaw, when the sub-grade is saturated. Most transportation agencies in northern climates reduce the allowable weight of trucks on designated roads during spring-thaw to avoid excessive damage to the road. Spring Load Restrictions (SLR) reduce the legal loads carried during this period by half, typically from mid-March to mid-May (9 –10 weeks). (For more information, please see Summer 2006 Road Talk article "Flexible Spring Loads", pg. 5). SLR impacts the heavy haul, truck-based industries, such as the forest industry, and by reducing the amount of product they can haul and their scheduling to get logs from the bush to the associated mills.

Recently, the forest industry has adopted a new technology on their trucks for use when hauling on forest roads, which they have found substantially reduces impact to road surfaces. This Central Tire Inflation (CTI) technology is well established, having been used for decades by themilitary. From the truck cabin, while stationary or moving, the truck driver can reduce the tire pressure, and increase the tire footprint. The net effect is a reduction of both static and dynamic loads on the road surface, and less impact to the road structure. When travelling on non-SLR posted road surfaces the tires can be centrally re-inflated back to a normal pressure.

The forest industry, represented by the Forest Engineering Research Institute of Canada (FERIC), approached the Ministry of Transportation Ontario (MTO) in 2005 with a request to partner in a series of demonstrations and trials, with the goal of MTO adopting CTI during the last 3-4 weeks of an SLR period. FERIC proposed that a British Columbia model be tried.

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Two sites were proposed for the next phase of the project, based on wood allocation, to commercially demonstrate the technology and prototype an administrative operating environment. The site chosen in Northwestern Region is on Hwy 601 (from 1.6 km north of Hwy. 17 west junction for 9.3 km north). The other site in Northeastern Region is on Hwy 651 (from Hwy. 101 junction for 28 km north).

To-date both test sites have been surveyed and baseline deflection readings taken. In late October, instrumentation to measure frost depth will be installed. The main activity, hauling 15 loads per day of wood chips or logs, will commence mid-April 2008.

The ministry has made a considerable commitment to this project, in support of the development of innovative technologies that encourage economic growth and prosperity of the province, while ensuring that the condition of our highways is not at risk

For more information, please contact
Tom Klement, Senior Research Engineer,
Highway Standards Branch at
(416) 235-3530 or
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A New Addition to MTO's Asset Management Toolkit:

Highway Element Investment Review Guidelines

With the development of its Highway Element Investment Review (HEIR) Guidelines, and accompanying spreadsheet calculation tool, MTO has taken another step toward ensuring its infrastructure dollars go where they'll bring the biggest benefit to highway users. The HEIR Guidelines replace the Prioritized Contract Content (PCC) Guidelines and is now the tool to use when determining the cost-effectiveness of elemental highway improvements.

As part of the HEIR Guidelines project, similar tools used across North America were reviewed. The new HEIR Guidelines is a state-of-the-art prioritization and justification tool that includes several noteworthy enhancements over the PCC Guidelines:

- a robust spreadsheet program that greatly simplifies benefit/cost calculations,
- improved formulas for estimating collision reduction,
- updated economic analysis methodology,
- the ability to analyze more highway elements types,
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- a detailed procedure with clear roles and responsibilities for storing and analyzing results,
- guiding philosophy on the relationship between cost-effectiveness and design
- updated guidance for improvements that have no collision reductio equations, and
- an explanation of how the HEIR Guidelines relates to the Corridor Investment Planning process.

Since the PCC Guidelines were first published in 1997, significant developments have been made in the science of estimating the performance of highway safety improvements. Examples include, the Science of Highway Safety initiative and the study of Collision Modification Factors completed for MTO in 2003. The HEIR Guidelines not only builds on these developments but also on the research carried out as part of the HEIR project.

The new HEIR Guidelines deal with specific improvements not covered by the ministry's other tools. The Guidelines include both benefit/cost equations and relevant non-economic considerations that should be reviewed when assessing potential highway improvements. It will supplement, rather than replace, the ministry's existing standards and policies.

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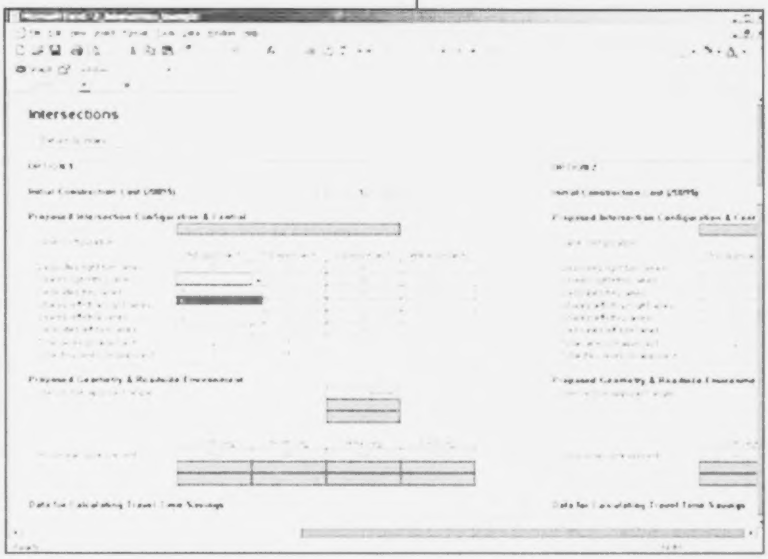

Figure 1: A robust spreadsheet calculation tool makes determining safety benefits – and the benefit/cost ratio – very easy to do.

Training courses are planned to start in fall 2007. Self-study training courses for the HEIR Guidelines and spreadsheet calculation tool are planned to be available on the MTO Intranet.

With the launch of the HEIR Guidelines, MTO will be one step closer to realizing its Asset Management goal of making "the right investment, in the right place, at the right time" ●

For more information, contact:
Wilf Roy, Head Design Innovation Section, at (905) 704-2544 or Wilf.Roy@ontario.ca

Figure 2: Worked examples help users understand how the tool works.

Central Tire Inflation Commercial Trial

Low volume roads, which include the 600-Series highways in Northern Ontario, are not designed to the same structural strength as high volume roads. These roads are at their weakest during spring-thaw, when the sub-grade is saturated. Most transportation agencies in northern climates reduce the allowable weight of trucks on designated roads during spring-thaw to avoid excessive damage to the road. Spring Load Restrictions (SLR) reduce the legal loads carried during this period by half, typically from mid-March to mid-May (9 –10 weeks). (For more information, please see Summer 2006 Road Talk article "Flexible Spring Loads"; pg 5). SLR impacts the heavy haul, truck-based industries, such as the forest industry, and by reducing the amount of product they can haul and their scheduling to get logs from the bush to the associated mills.

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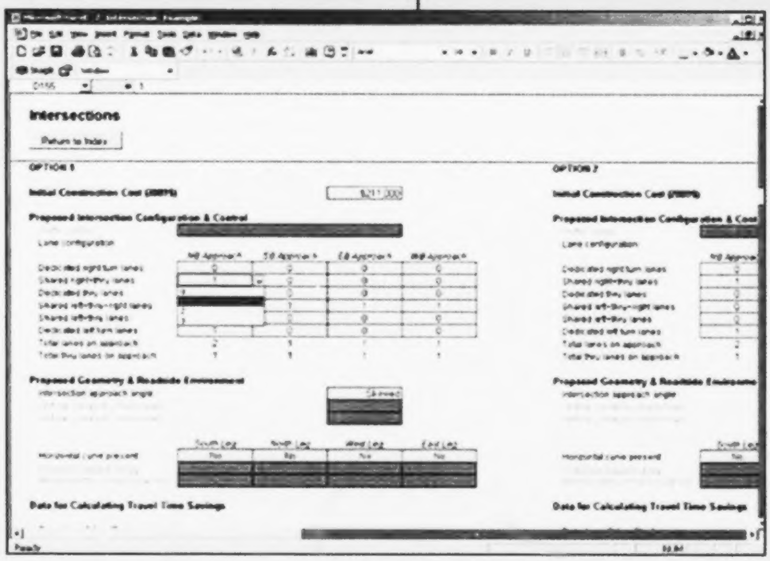

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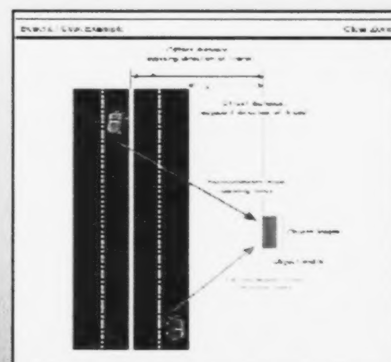

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